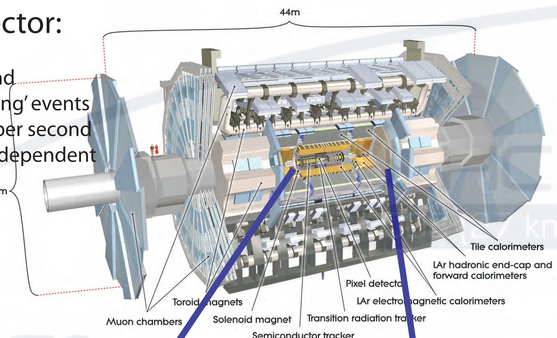
The ATLAS Experiment at CERN

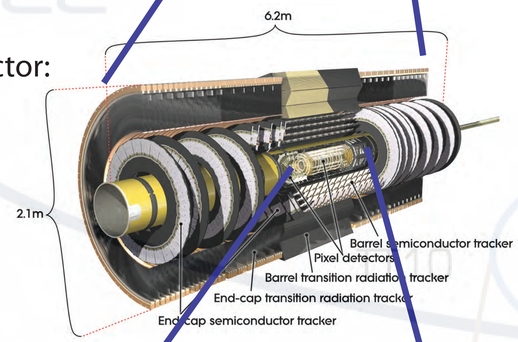
The Pixel Detector: 80 Million Channels and Always Something Interesting to Watch

The ATLAS Detector:

~15,000,000 pounds
~80 meters underground
- Identifies 100 'interesting' events out of 6 million events per second
- Comprised of many independent sub-detectors
~300 MB/s data output rate

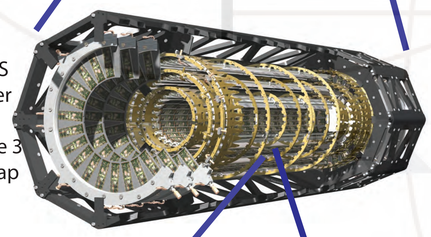


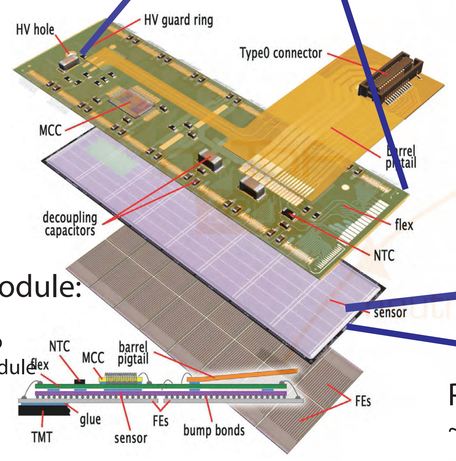
The Inner Detector:



The Pixel Detector:

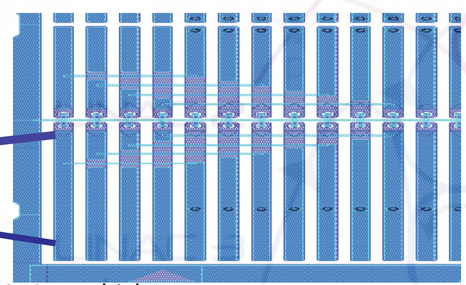
- Innermost detector of ATLAS
~ 1.2 m long , 0.35 m diameter
~4.4 kg weight
-1744 Pixel Modules comprise 3 cylindrical layers and 3 endcap layers
~80 Million data channels
~10 kW power usage





A Pixel Detector Module:

~ 6 cm long X 2 cm wide
~46,000 pixels connected to 16 "Front End" chips per module
~40 Mbit/s data output rate



Pixel Sensors:

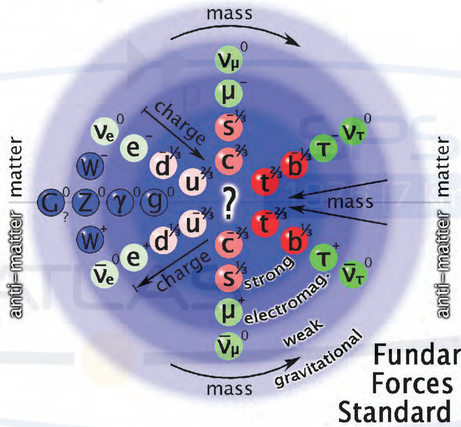
~40 x 400 um^2 x 250 um thick
- Charged particles produced in the collisions pass through the sensors, creating a measurable current.

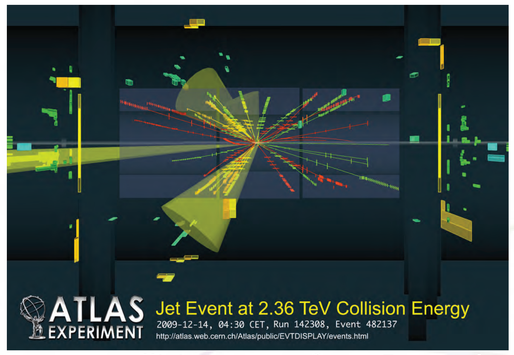
What will be discovered with ATLAS ??

When the LHC begins its 7 TeV p-p collisions in 2010

Will the Higgs boson finally be observed?
Supersymmetric particles??
Extra Dimensions???

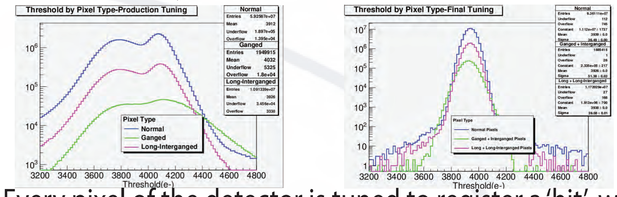
Or Maybe....Something totally unexpected!



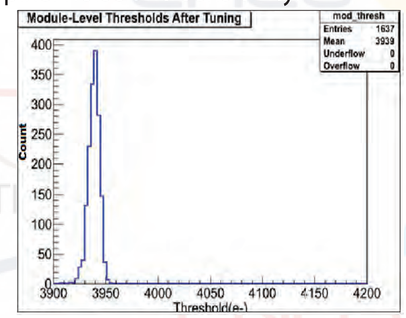


A proton-proton collision event from December 14, 2009

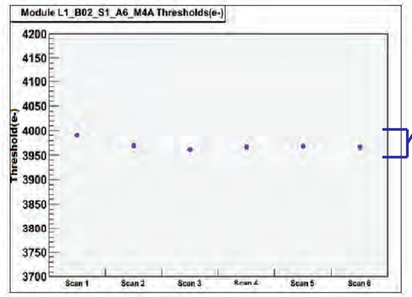
My research at CERN:



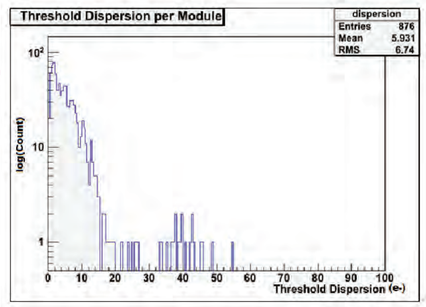
Every pixel of the detector is tuned to register a 'hit' when the amount of charge created by a particle exceeds a certain threshold. This threshold is chosen at a balance point between pixel noise and sensitivity.



A mean module-level threshold can be found for each module and plotted to give an overall view of the detector.



Quantification of the variation in the modules' thresholds over time is an important part of understanding the detector.



The average module threshold dispersion was equal to charge of only 6 e- over a period of six months.

High dispersion corresponded to known module issues. This means that a modulel's threshold dispersion in time provides a good measure of its health.

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